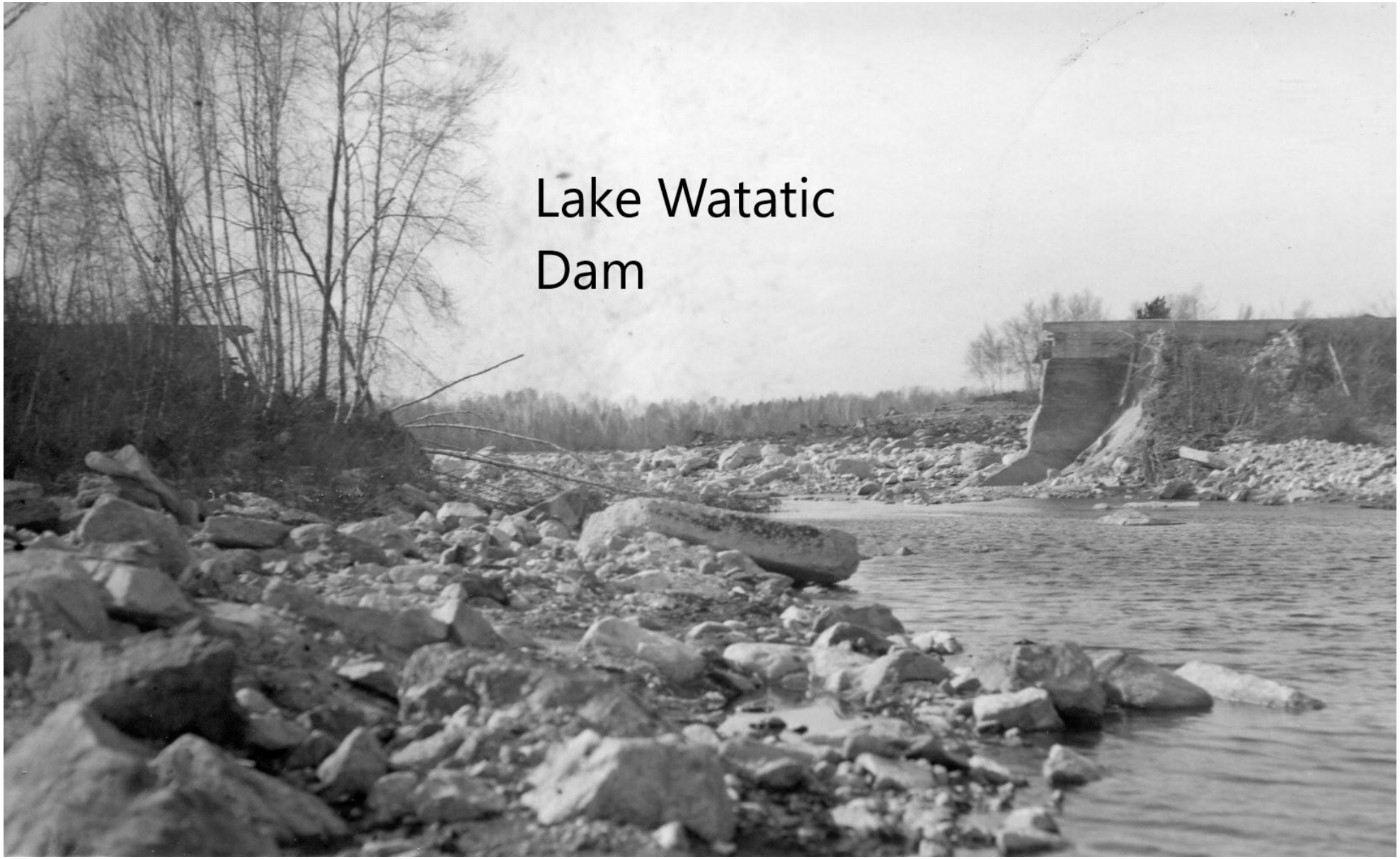
Lake Watatic

Dam Engineering Project

Brief History of Watatic Lake Dam

- The dam was originally built in the early 1900's
- The hurricane in 1938 caused a major dam breach with significant damage
- The town of Ashburnham assumed ownership of the dam in the 1980's which makes ***the town responsible for and liable for the dam maintenance and repair***
- Twenty years ago an engineering inspection of the dam determined there were several deficiencies; most notably the spillway is inadequate.
- There have been several inspections since, all drawing the same conclusions
- 2010 – The state required an EAP Report (Emergency Action Plan Report). The following are the findings from the EAP:
  - **A major storm would cause another dam failure**
  - **The current dam spillway is inadequate**
  - **The result of a Lake Watatic dam failure: Loss of property and possibly loss of lives**
  - **The loss of Watatic Lake, Lower Naukeag Lake, Whitney Pond, part of East Rindge Road, possibly Sherbert Road and Rt 12**


Bridge on
East
Rindge at
Cross
Road


Lake Watatic
Dam


Bridge at Cross
Road & East
Rindge Road

DRAFT

LAKE WATATIC DAM

ASHBURNHAM, MA

EMERGENCY ACTION PLAN

April 2011

Dam Name:	Lake Watatic Dam
State Dam ID#:	3-14-11-10
NID ID#:	MA00004
Owner:	Town of Ashburnham
Owner Type:	Municipality
Town:	Ashburnham
Consultant:	GZA GeoEnvironmental, Inc.

1.34 DCR Size and Hazard Classification

The Lake Watatic Dam has a height of dam of approximately 20 feet and a maximum storage capacity of about 1,500 acre-feet. Therefore, in accordance with Department of Conservation and Recreation Office of Dam Safety classification, under Commonwealth of Massachusetts dam safety rules and regulations stated in 302 CMR 10.00 as amended by Chapter 330 of the Acts of 2002, Lake Watatic Dam is a **Large** size structure.

Based upon the extent of the inundation area due to the hypothetical dam failure of the Lake Watatic Dam, homes and roads and several businesses would be flooded and loss of life could occur. Additionally, GZA has estimated that in the event of the failure of Lake Watatic Dam, the dam break flood wave generated will likely create a domino failure of the Lower Naukeag Lake Dam which is a High hazard structure. The current hazard classification of Lake Watatic Dam is Significant. However, in accordance with Department of Conservation and Recreation classification procedures, under Commonwealth of Massachusetts dam safety rules and regulations stated in 302 CMR 10.00 as amended by Chapter 330 of the Acts of 2002, GZA recommends that Lake Watatic Dam should be re-classified as a **High Hazard (Class I)** potential dam. Note that the August 10, 2010 Phase I inspection report indicated that at the time of inspection, the dam was in FAIR condition.

1.35 Drainage Area

The contributory drainage area for Lake Watatic Dam is approximately 6.2 square miles and extends through the communities of New Ipswich and Rindge, New Hampshire and Ashburnham, Massachusetts. The watershed consists of primarily hilly, wooded areas with minimal development.

1.36 Reservoir Storage and Surface Area

	Length (feet)	Width (feet)	Surface Area[1] (acres)	Storage Volume[2] (acre-feet)
Normal Pool	5,300	680	150	820
SDF Pool (Existing - 500 year)	5,700	900	183	1,450
SDF Pool (Proposed – ½ PMF)	5,820	1,050	200	1,973
Maximum Pool	5,800	1,000	195	1,500

[1] Estimated based on assumed areas from a topographic map of Watatic Lake

[2] These data were calculated by GZA based on the Conic Method for Reservoir Values using POND2 software and topographic maps.

narrow and constricted to wide flood plains. Manning's "n" roughness coefficients used in the river model were from 0.04 to 0.06 for the channel areas, and from 0.06 to 0.08 for the overbank areas. The values used are consistent with the range of values used in the FEMA Flood Insurance Studies for the Towns of Ashburnham and Winchendon.

4.30 Model Calibration

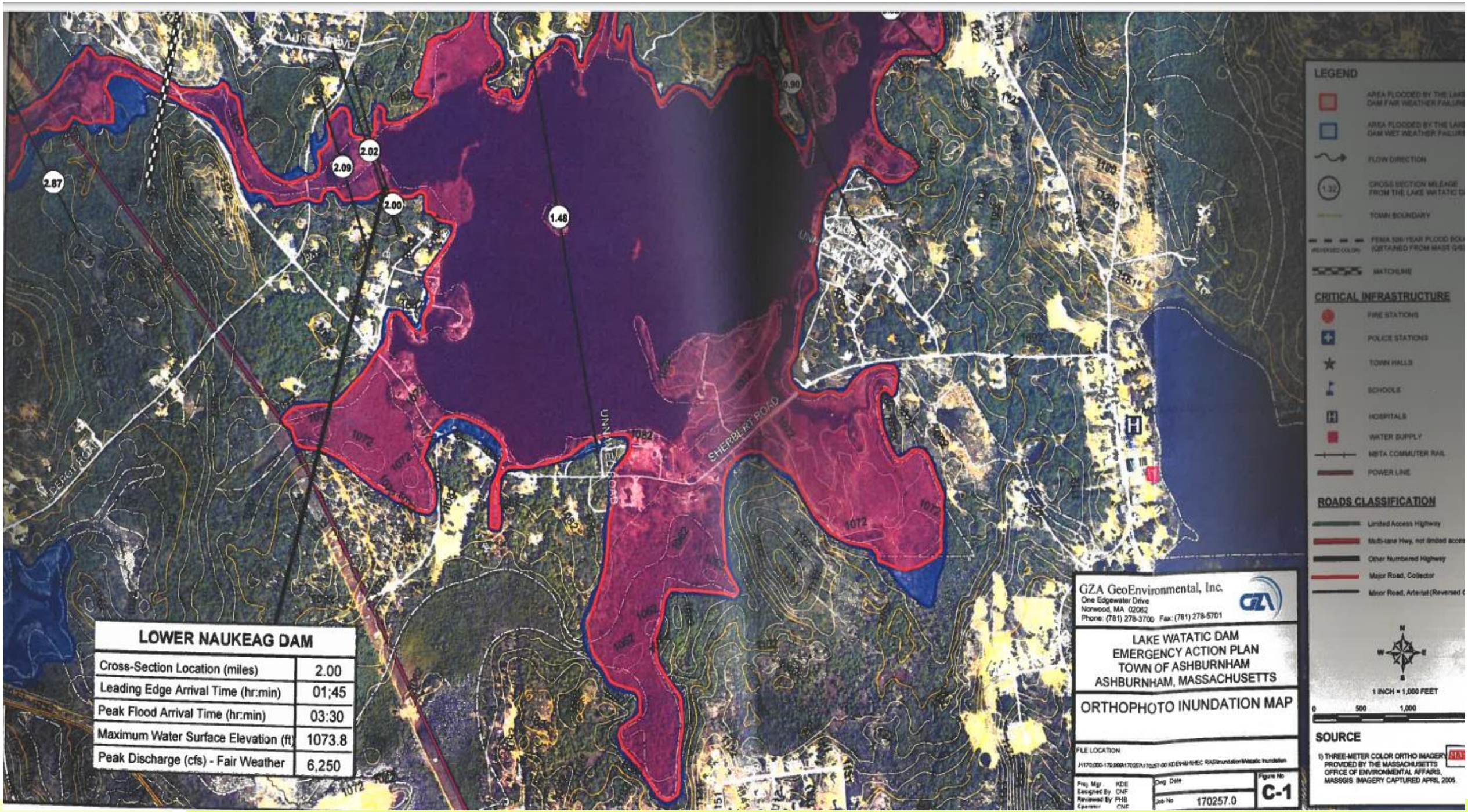
The HEC-RAS model was calibrated to the FEMA Flood Insurance Studies (FIS) for the Towns of Ashburnham and Winchendon by running the published FEMA 100-year peak flows through the model under steady-state conditions. Water surface elevations were calibrated to the published FEMA 100-year flood levels by adjusting Manning's n values, streambed invert elevations, and cross section geometries, where necessary and within a reasonable range based on GZA's professional judgment of the physical/hydraulic setting of Lake Watatic and the stream. A comparison of the 100-year flood depths obtained using HEC-RAS to those contained in the FEMA study generally showed good agreement (i.e., within 3 feet).

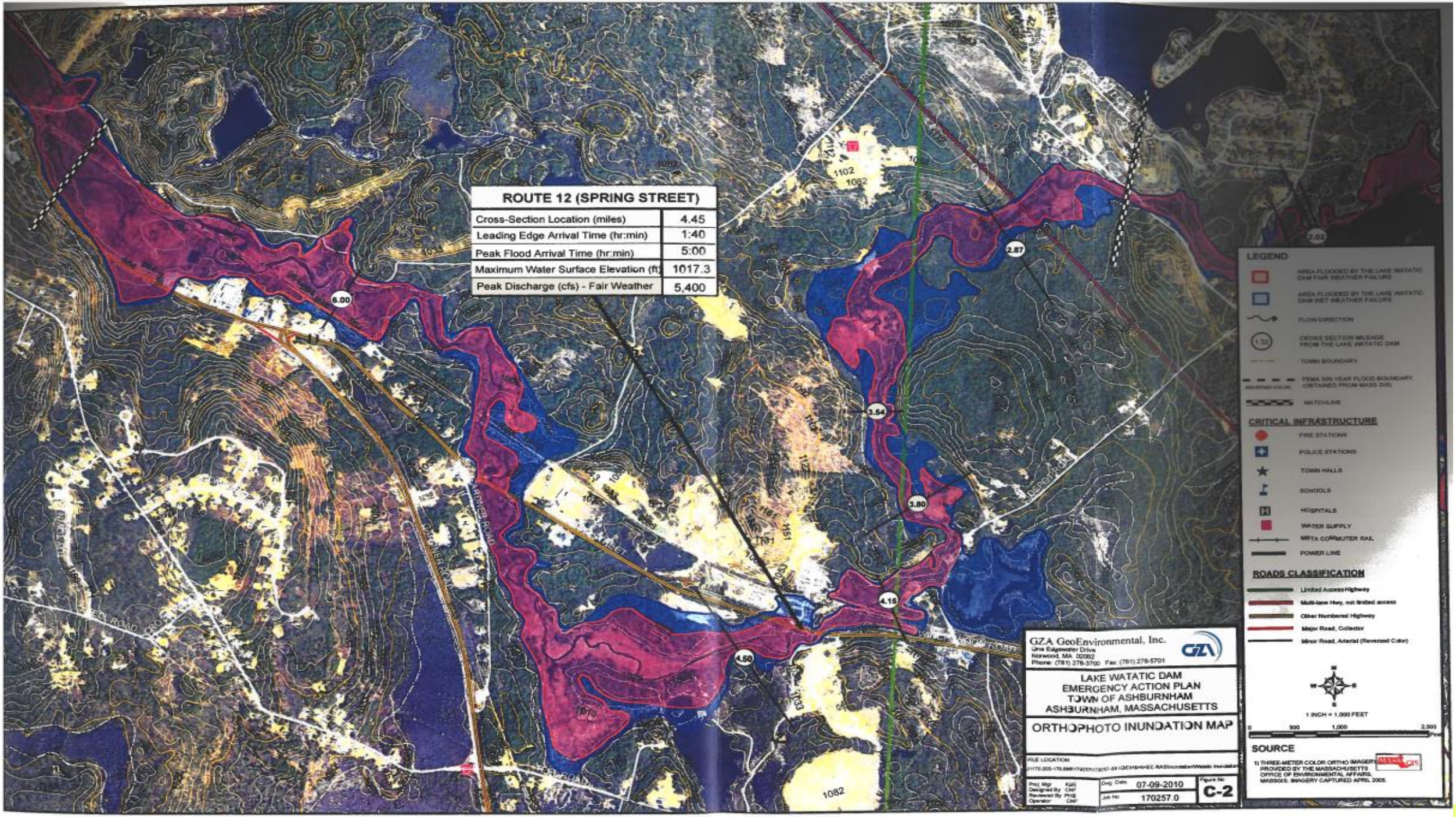
4.40 Breach Description

Dam breach parameters such as time of breach formation, breach shape, and the average width of the breach were selected according to these conditions and based upon the type of materials used in constructing the dam. These factors were developed in accordance with the recommended range of values published in the Federal Energy Regulatory Committee (FERC) guidelines and based on engineering judgment.

For the Lake Watatic Dam, the dam breach was modeled at the embankment, which comprises the maximum section of the dam. The dam is an earthen embankment, and was modeled with a time to maximum breach formation of 0.5 hours. The breach width at the center elevation of the dam was assumed to be equal to three times the height of the dam therefore the final bottom breach width was assumed to be 50 feet while the average breach width was assumed to be 60 feet. The breach shape was assumed to be trapezoidal, with 0.5H:1V side slopes.

Failure of the Lake Watatic Dam under wet weather conditions is expected to lead to the "domino" failure of Lower Naukeag Lake Dam and Whitney Pond Dam, which were included in the HEC-RAS model and were modeled to fail at the peak elevation caused by the upstream dam failures. Hunts Pond Dam and Tannery Pond Dam are also expected to fail due to the Lake Watatic Dam failure. However, Hunts Pond Dam and Tannery Pond Dam were not included in the model due to their limited storage capacity. Under fair weather conditions, a failure of the Lake Watatic Dam is expected to lead to the "domino" failure of the Lower Naukeag Lake Dam but not the Whitney Pond Dam.


LEGEND
AREA FLOODED BY THE LAKE DAM FAIR WEATHER FAILURE
AREA FLOODED BY THE LAKE DAM WET WEATHER FAILURE
FLOW DIRECTION
CROSS SECTION MILEAGE FROM THE LAKE WATATIC DAM
TOWN BOUNDARY
FEMA 500-YEAR FLOOD BOUNDARY (OBTAINED FROM MASS GIS)
WATERLINE
CRITICAL INFRASTRUCTURE
FIRE STATIONS
POLICE STATIONS
TOWN HALLS
SCHOOLS
HOSPITALS
WATER SUPPLY
MBTA COMMUTER RAIL
POWER LINE
ROADS CLASSIFICATION
Limited Access Highway
Multi-lane Hwy, not limited access
Other Numbered Highway
Major Road, Collector
Minor Road, Arterial (Reversed C
1 INCH = 1,000 FEET
0 500 1,000
SOURCE
1) THREE-METER COLOR ORTHO IMAGERY PROVIDED BY THE MASSACHUSETTS OFFICE OF ENVIRONMENTAL AFFAIRS, MASSGIS IMAGERY CAPTURED APRIL 2005.
LOWER NAUKEAG DAM
Cross-Section Location (miles) 2.00
Leading Edge Arrival Time (hr:min) 01;45
Peak Flood Arrival Time (hr:min) 03:30
Maximum Water Surface Elevation (ft) 1073.8
Peak Discharge (cfs) - Fair Weather 6,250
GZA GeoEnvironmental, Inc.
One Edgewater Drive
Norwood, MA 02062
Phone: (781) 278-3700 Fax: (781) 278-5701
LAKE WATATIC DAM
EMERGENCY ACTION PLAN
TOWN OF ASHBURNHAM
ASHBURNHAM, MASSACHUSETTS
ORTHOPHOTO INUNDATION MAP
FILE LOCATION
Proj Mgr KDE
Designed By CNF
Reviewed By PHB
Dwg Date
Job No 170257.0
Figure No C-1
2.87
2.09
2.02
2.00
1.48
0.90
LAUREL DRIVE
DEPOT ROAD
UNNAMED ROAD
SHERRY ROAD
1072
1082
1092
1131
1189


ROUTE 12 (SPRING STREET)
Cross-Section Location (miles) 4.45
Leading Edge Arrival Time (hr:min) 1:40
Peak Flood Arrival Time (hr:min) 5:00
Maximum Water Surface Elevation (ft) 1017.3
Peak Discharge (cfs) - Fair Weather 5,400
6.00
4.50
4.15
3.80
3.64
2.87
LEGEND
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AREA FLOODED BY THE LAKE WATATIC DAM WET WEATHER FAILURE
FLOW DIRECTION
CROSS SECTION MILEAGE FROM THE LAKE WATATIC DAM
TOWN BOUNDARY
FEMA 500-YEAR FLOOD BOUNDARY (OBTAINED FROM MASS GIS)
MATCHLINE
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POLICE STATIONS
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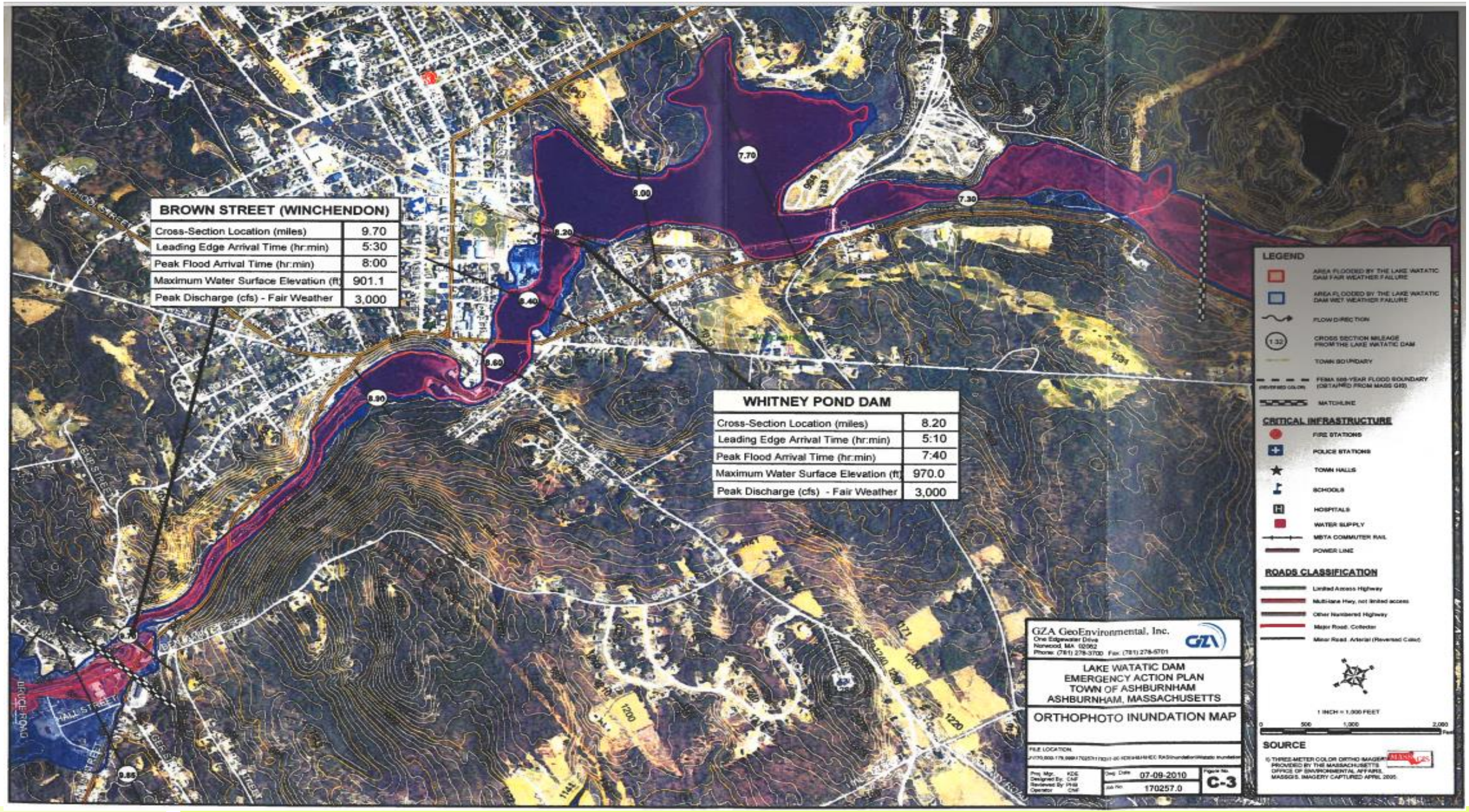
ASHBURNHAM, MASSACHUSETTS
ORTHOPHOTO INUNDATION MAP
Proj. Mgr. KMS
Designed By CMP
Reviewed By PHS
Operator CMP
Dwg. Date 07-09-2010
Job No. 170257.0
Figure No. C-2


BROWN STREET (WINCHENDON)
Cross-Section Location (miles) 9.70
Leading Edge Arrival Time (hr:min) 5:30
Peak Flood Arrival Time (hr:min) 8:00
Maximum Water Surface Elevation (ft) 901.1
Peak Discharge (cfs) - Fair Weather 3,000
WHITNEY POND DAM
Cross-Section Location (miles) 8.20
Leading Edge Arrival Time (hr:min) 5:10
Peak Flood Arrival Time (hr:min) 7:40
Maximum Water Surface Elevation (ft) 970.0
Peak Discharge (cfs) - Fair Weather 3,000
LEGEND
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TOWN OF ASHBURNHAM
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ORTHOPHOTO INUNDATION MAP
FILE LOCATION
Proj. Mgr. KDS
Designed By: CMF
Reviewed By: PHB
Operator CMF
Dwg. Date 07-09-2010
Job No. 170257.0
Figure No. C-3
7.70
8.00
7.30
8.20
8.40
8.60
8.90
9.85
9.70

"Why should I pay for this? I don't use the lake."

- The town of Ashburnham is legally and financially responsible for the maintenance and repair of the dam as well as failure outcomes
- It's a long term investment for the town (prevention vs recovery)
- The property on the lake is valued at over $40 million and the town collects over $767,887 (based on assessed tax rate)
- Lake Watatic homes would be devalued, resulting in a minimum loss of $268,760 per year of tax revenue per year(this does not include Lower Naukeag homes)
- Home owners could bring law suits against the town for the loss of value and loss of use and enjoyment of their property
- You, the tax payer, would ultimately pay for the result

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